Report to the
Evaluation Monitoring Demonstration Project
Technical Advisory Committee
Devoted to
Review of Upper Newport Bay-San Diego Creek Current Water Quality, Aquatic Life Toxicity Study Results and Recommendations for Future Studies

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Background To Developing the Evaluation Monitoring Demonstration Project

This Evaluation Monitoring Demonstration Project report to the Technical Advisory Committee (TAC) presents a summary of the Phase I, July 1, 1996 through June 30, 1997, studies devoted to demonstrating an alternative approach to stormwater runoff water quality monitoring for assessing the impact of stormwater runoff associated constituents on the beneficial uses of receiving waters in the Upper Newport Bay watershed. A summary of the toxicity testing results obtained as part of the Phase I and Phase II studies during the fall of 1996 and 1997 is also presented.

Evaluation Monitoring v. Conventional "Water Quality" Monitoring

Conventional stormwater runoff "water quality" monitoring measures a suite of chemicals in runoff waters, and possibly in receiving waters, for several storm associated runoff events over a year. The chemical concentrations and, if flow data is available, loads, of the constituents are then used to attempt to extrapolate to water quality impacts. While widely used and expensive, this approach is not reliable for assessing the water quality impacts of stormwater runoff associated constituents on the beneficial uses (pollution) of the receiving waters. It is also not a technically valid base for developing best management practices (BMPs) for the control of stormwater runoff water quality problems caused by the stormwater runoff associated constituents.

The Evaluation Monitoring approach focuses the monitoring resources on developing the information needed to define real water quality use impairments in the receiving waters for the stormwater runoff that are of sufficient significance to the public to warrant expenditures for chemical constituent(s), pathogenic organism and other materials control in the stormwater runoff. While the conventional stormwater runoff "water quality"monitoring approach focuses resources on measuring heavy metals and other potentially toxic constituents, and then an attempt is made to try to extrapolate the chemical concentration, load data to toxicity impacts in the receiving waters, the Evaluation Monitoring approach focuses resources on determining whether the receiving waters for the runoff event are toxic and if toxic, determines the extent, duration and magnitude of the toxicity to key organisms. If the stakeholders in a watershed based Evaluation Monitoring program determine that the toxicity is significantly adverse to the beneficial use of the waterbody, then,

through forensic studies and toxicity investigation evaluation (TIEs), it is possible to identify the toxic components and determine their sources. At that time, site-specific BMPs can be implemented to control the toxic components and/or toxicity, usually through source control, to the maximum extent practicable (MEP).

The conventional approach leads to continued support for conventional, hydraulic-based BMPs, such as detention basins, filters, grassy swails, etc., which are now recognized as being largely ineffective in removing chemical constituents in stormwater runoff that are toxic to receiving water aquatic life, such as the dissolved heavy metals. In May, 1995, the US EPA officially adopted an ambient water dissolved heavy metal regulatory approach, which makes detention basins, filters and some other conventional BMPs non-BMPs for potentially toxic chemicals. The Evaluation Monitoring approach, on the other hand, focuses specifically on defining those constituents responsible for significant water quality use impairments, and then provides guidance on how to develop site-specific BMPs to control those constituents to the MEP.

The Evaluation Monitoring approach will typically lead to significantly different BMPs that are specifically designed to solve real water quality problems in a technically valid, cost-effective manner. The conventional stormwater runoff monitoring, focusing on determining chemical concentrations and loads, does not address chemical impacts, and therefore does not determine if the chemical constituents in the runoff are pollutants-causing water quality use impairments.

The value of the Evaluation Monitoring approach has been demonstrated during the Phase I Demonstration Project, through direct toxicity measurements defining a potentially significant real water quality use impairment in San Diego Creek and Upper Newport Bay due to organophosphate and other pesticides.

The Evaluation Monitoring Demonstration Project results have provided the technical base for obtaining US EPA sponsored 205(j) and 319(h) grants which enable expansion of the Demonstration Project into a more comprehensive evaluation of aquatic life toxicity and bioaccumulation of hazardous chemicals in aquatic organisms' edible tissue than is possible within the demonstration project. The 205(j) and 319(h) grants are part of the Santa Ana Regional Water Quality Control Board's watershed initiative for Upper Newport Bay. The studies that will be conducted as part of these grants will serve to provide technical information needed by the Regional Board to develop TMDLs for the control of toxic components entering Upper Newport Bay.

Current Water Quality/Use Impairment Problems in Upper Newport Bay and San Diego Creek

As part of the Evaluation Monitoring Demonstration Project Phase I studies, a report, "Review of Existing Water Quality Characteristics of Upper Newport Bay, Orange County CA and its Watershed," June 1997, has been prepared which summarizes the current water quality characteristics of Upper Newport Bay and its San Diego Creek watershed. The beneficial uses of Upper Newport Bay are impaired due to excessive fertilization, siltation-sediment accumulation,

sanitary quality, low dissolved oxygen, and litter. This report concludes that, while there are a number of potentially toxic constituents, such as heavy metals and some organics, present in San Diego Creek waters as they enter Upper Newport Bay, studies have not been conducted to determine whether the heavy metals and other potentially toxic constituents were in available/toxic forms. Further, there was some evidence, based on limited scope toxicity testing conducted in the early 1990s, that San Diego Creek, as it enters Upper Newport Bay, was toxic to *Ceriodaphnia*, a standard, freshwater zooplankton. Based on a review of the existing water quality characteristic information for Upper Newport Bay, it was decided that the Evaluation Monitoring Demonstration Project should focus the field studies on toxicity testing of San Diego Creek waters as they enter Upper Newport Bay, in order to assess whether there was potentially significant aquatic life toxicity to be adverse to the beneficial uses of Upper Newport Bay and San Diego Creek.

San Diego Creek Aquatic Life Toxicity Studies

In the fall of 1996, two, approximately one-inch per one-day stormwater runoff events were monitored for aquatic life toxicity at the Campus Drive crossing of San Diego Creek. Also, a dry weather base flow sample was taken at this location between these two storms. No samples were collected during the winter or spring of 1997 because of the limited precipitation that occurred during this time.

During the fall of 1997, three stormwater runoff events have been sampled at Campus Drive. One of these was a low-intensity storm in which there was little, if any, runoff from pervious surfaces; another was a more typical one-inch per one-day storm, similar to the storms sampled during the fall of 1996; and the third was the very large storm that occurred in early December, 1997. In addition, one set of samples was taken of San Diego Creek within the watershed during this storm runoff event. Further, several samples were taken over the course of this storm's runoff event, and one sample of rainfall was collected for pesticide chemical analysis at the beginning of this storm.

All samples that have been collected for toxicity measurements were tested for toxicity to *Ceriodaphnia dubia*, a freshwater zooplankton. The two most recent sets of samples have also been tested for toxicity to *Mysidopsis bahia*, a marine zooplankton, where the salinity of the San Diego Creek water was increased to 20 ppt, to more closely simulate the conditions that exist in Upper Newport Bay where San Diego Creek waters mix with the Bay waters during a stormwater runoff event. The initial samples taken in the fall of 1996 and the fall of 1997 were also tested for toxicity to fathead minnow larvae, and the initial set of samples taken in the fall of 1996 were tested for toxicity to the alga *Selenastrum capricornutum*.

The toxicity testing for toxicity included, for many of the samples, a dilution series, with and without the addition of PBO (piperonyl butoxide). This approach establishes the total magnitude of the toxicity in the sample, i.e. toxic units, as well as providing information on whether organophosphate pesticides are possibly responsible for the toxicity.

All of the samples collected have been tested using ELISA procedures for diazinon and chlorpyrifos. These procedures are highly specific for analysis of the organophosphate pesticide concentrations in the samples. Also, some samples have been analyzed using dual-column gas chromatographic procedures.

A report, "Aquatic Life Toxicity in Stormwater Runoff to Upper Newport Bay, Orange County, California: Initial Results," June 1997, presenting the results of the fall 1996 sampling has been prepared. Further, an invited presentation "Stormwater Runoff Toxicity in Orange County, CA: A Demonstration of Evaluation Monitoring," of the results has been made to the state of California Stormwater Quality Task Force in early November, 1997. A copy of the slides used in this presentation, as well as the June 1997 reports, are available upon request. A report covering the fall 1997 and subsequent 1998 studies will be prepared during June 1998 as part of reporting the Phase II study results.

The fall 1996 studies showed that San Diego Creek, as it enters Upper Newport Bay, contains high levels of *Ceriodaphnia* toxicity during stormwater runoff events. No toxicity was found to fathead minnow larvae or the alga.

Sufficient San Diego Creek toxicity sampling has been accomplished this fall to demonstrate that the toxicity pattern observed during the fall of 1996 has occurred in the fall of 1997. The overall conclusions from the two years of fall stormwater toxicity studies is that during periods of stormwater runoff, San Diego Creek, at the point where it enters Upper Newport Bay, contains from three to ten *Ceriodaphnia* toxicity units. This means that San Diego Creek water could be diluted up to ten times with non-toxic water and still be toxic to *Ceriodaphnia*. While studies in the San Francisco Bay region and in the Sacramento/Davis area have also found diazinon or diazinon and chlorpyrifos-caused toxicity in urban stormwater runoff, in general, the San Diego Creek samples have higher levels of *Ceriodaphnia* toxicity than other urban stormwater runoff samples collected in other parts of the state.

It appears that the higher levels of toxicity are associated with greater magnitude runoff events, where there is runoff from pervious surfaces. Associated with the higher levels of toxicity is a significant amount of non-diazinon and chlorpyrifos-associated/caused *Ceriodaphnia* toxicity.

Another general conclusion is that the toxicity is associated with stormwater runoff events and does not occur during base flow conditions in San Diego Creek.

It is also found that the toxicity that has been found in the early parts of a storm, which was when most of the sampling was done in order to determine first flush characteristics of the runoff, is apparently present throughout the stormwater runoff event.

The rainfall sample collected in Irvine, California during the early December storm contained measurable, but apparently non-toxic, amounts of diazinon.

The limited sampling that has been done in the San Diego Creek watershed during a runoff event has shown that the organophosphate pesticides are present in each of the major tributaries to San Diego Creek at about the same concentrations. This is an area that should receive considerable additional study during the winter, spring and fall 1998 sampling.

It has also been found that the San Diego Creek toxicity to *Ceriodaphnia* shows at least similar and possibly greater levels of toxicity to mysids, and therefore there is a potential for toxicity that is present in San Diego Creek to adversely impact the marine aquatic life beneficial uses of Upper Newport Bay.

The diazinon and chlorpyrifos-caused toxicity is likely due to urban area use. At least part of the toxicity to *Ceriodaphnia* in San Diego Creek is due to agriculturally used pesticides. During major runoff events, approximately half of the toxicity found is being caused by unidentified constituents.

These are all tentative conclusions based on limited data, but they are sufficiently well established so that it can be concluded that there is a potentially significant aquatic life toxicity problem in San Diego Creek and Upper Newport Bay that needs to be evaluated with respect to its potential impacts on the beneficial uses of both of these waterbodies.

One of the key issues that needs to be addressed with respect to general aspects of the toxicity is whether the toxicity patterns found in the fall of each year occur during late winter and spring. This will be one of the areas that will be addressed in winter and spring, 1998 sampling. What is found in the fall stormwater runoff events should be expected to be found during the winter and spring as well, based on the fact that diazinon and chlorpyrifos are used in Orange County at the rate of several thousand pounds per month, each month over the year. The Phase II Demonstration Project Evaluation Monitoring sampling will include one additional sampling of San Diego Creek at Campus Drive during late winter/early spring, in order to determine if the toxicity patterns found in the fall of 1996/1997 are present at other times of the year.

Future Studies

Based on the results of the Evaluation Monitoring Demonstration project, the San Diego Creek stormwater runoff Upper Newport Bay toxicity studies should place emphasis on two directions. The Upper Newport Bay studies should focus on determining the water quality-use impairment significance of the aquatic life toxicity that has been found to both fresh and marine organisms in San Diego Creek waters associated with stormwater runoff events. Also, the Bay studies should focus, through a more detailed toxicity investigation evaluation (TIE) than has been conducted thus far, on the causes of the toxicity found in the San Diego Creek waters as it enters Upper Newport Bay.

The San Diego Creek watershed studies should focus on determining the specific sources of the toxicity and toxic components that contribute to the overall toxicity of San Diego Creek as it

enters Upper Newport Bay. Associated with the watershed studies in connection with one of the winter 1998 storms, a detailed sampling of each of the major tributaries of San Diego Creek should be sampled twice (early and late) in a stormwater runoff event. The magnitude of the event should try to be a one-inch per one-day storm. This sampling would determine whether any parts of the watershed are contributing aquatic life toxicity and toxic components in greater amounts than other areas. Further, during the winter 1998, sampling of other tributaries of Upper Newport Bay should be done during a stormwater runoff event to estimate the magnitude of toxicity entering the Bay from these sources. Of particular concern is the Santa Ana Delhi Channel, as well as the Big Canyon drainage.

In cooperation with the University of California, Davis Aquatic Toxicology Laboratory, and Dr. Val Connor of the Central Valley Regional Water Quality Control Board, Dr. Lee has initiated a study of how organophosphate pesticides move off of his and other properties in the El Macero (Davis) area. Similar studies have been conducted by Jim Scanlin of the Alameda County Flood Control and Water Conservation District. He has found, as has Dr. Lee, that the application of organophosphate pesticides to urban properties above the soil surface, in accord with recommended use, leads to organophosphate pesticide transport off of the property, into the stormwater drainage way. It is unclear at this time, however, whether subsurface application of these pesticides, such as for termite control, also leads to significant pesticide transport in stormwater and fugitive water runoff from the property.

It is suggested that a similar kind of study be developed in Orange County, where one or more individuals will personally take samples of stormwater runoff where organophosphate pesticides (diazinon and chlorpyrifos) have been applied to residential properties in accord with recommended procedures, to determine the magnitude of runoff of these pesticides during various runoff events. In addition to stormwater runoff, sampling should be conducted of fugitive waters, associated with over-watering of lawns and gardens, that enters the stormwater drainage system of the area. This type of information will be a key component of determining whether it will be possible to control, using currently allowed formulations and application practices, the transport of organophosphate pesticides from urban residential properties to a sufficient extent to prevent significant aquatic life toxicity in San Diego Creek and Upper Newport Bay.

Since agricultural practices in the San Diego Creek watershed have been identified as a source of aquatic life toxicity caused by methomyl, it will be important to specifically target agricultural runoff from various types of crops during the fall and spring for sampling to determine whether this runoff is a source of aquatic life toxicity. Further, specific sampling should be conducted to examine irrigation return waters for aquatic life toxicity. There will be need to work with the County Agricultural Commissioner and others to select the locations for this type of sampling.

Because of the potential importance of nurseries within the San Diego Creek watershed as a source of pesticide toxicity, the watershed studies should specifically examine the toxicity of any

stormwater runoff as well as irrigation water drainage from nursery areas to determine if these areas are important sources of aquatic life toxicity in San Diego Creek, as well as Upper Newport Bay.

There is need to prioritize areas of the Upper Newport Bay watershed for special purpose sampling that can be done within the budgets available. This issue will be discussed at the January 6 TAC meeting.

Since in some areas of the state atmospheric transport of organophosphate pesticides associated with agricultural use is an important source of pesticide toxicity in stormwater runoff, it will be important to sample rainfall in Orange County, preferably in an urban area and in an agricultural area, to determine whether aquatic life toxicity, as well as organophosphate pesticides, are present in the precipitation to be a significant source of aquatic life toxicity in San Diego Creek, as it enters Upper Newport Bay. This sampling should be done early in the precipitation event, since studies conducted by Dr. Val Connor in the Sacramento Valley region have shown that the highest concentrations of diazinon are found in rainfall at the time that the precipitation first occurs. There is need to review this matter and determine where best to do the rainfall sample collection within the San Diego Creek/Upper Newport Bay watershed.

In general, the forensic studies of the Upper Newport Bay's watershed will focus primarily on ELISA testing for diazinon and chlorpyrifos and any other constituents for which there are ELISA kits that have been identified as a cause of toxicity in San Diego Creek as it enters Upper Newport Bay. Occasionally, toxicity test samples would be taken at various locations in the watershed to verify that the patterns found in San Diego Creek at Campus Drive are applicable in other parts of the watershed.

Identification of the Cause of Aquatic Life Toxicity

The fall 1996 and 1997 studies have both found that there is substantial *Ceriodaphnia* toxicity that cannot be accounted for by diazinon and chlorpyrifos. While it was possible, in the second runoff event monitored in the 1996 studies, to determine, through gas chromatographic analysis and reported toxicities, that methomyl was likely responsible for some of the unknown toxicity, there are still several toxic units of unidentified toxicity that need to be examined with respect to their cause. One of the major efforts of future studies should be to determine, to the extent possible within the financial constraints that exist, the cause of the unknown toxicity in San Diego Creek waters as they enter Upper Newport Bay.

In the studies that have been conducted thus far, highly directed TIE involving the use of PBO additions to the toxicity tests and ELISA testing for chlorpyrifos and diazinon have been used to determine if these types of chemicals, and specifically these two chemicals, are present in the San Diego Creek waters at sufficient concentrations to be potentially toxic to *Ceriodaphnia*. This approach has been successful in accounting for approximately half of the toxicity in several of the San Diego Creek samples. However, more extensive and expensive TIE studies will be needed to

try to identify the other cause(s) of the toxicity in San Diego Creek waters as they enter Upper Newport Bay.

The primary toxicity testing that should be done with the remainder of this year's project funds will be devoted to determining the cause of the unidentified toxicity that has been found in several San Diego Creek samples in the fall of 1996 and 1997. Dr. Lee has conducted discussions of the issue with those in the Sacramento region and San Francisco Bay region who have been involved in the issues of identifying the cause of toxicity in urban stormwater runoff. He has concluded that further TIE work should focus on the use of conventional US EPA guidance for conducting TIEs. With one of the next major stormwater runoff events in which there is large amounts of unknown-caused toxicity, a US EPA Phase I TIE will be used to begin to classify the chemical(s) that are responsible for this toxicity, i.e. heavy metals, low or high molecular weight organics, etc. This is the recommended approach by Dr. Chris Foe of the Central Valley Regional Water Quality Control Board who has conducted extensive work of this type in California. Following the US EPA Phase I TIE studies, decisions will be made on how best to proceed to further characterize the individual compounds responsible for the unknown toxicity that is being found in San Diego Creek samples as the water enters Upper Newport Bay.

While the ultimate decisions on the TIE approach that will be followed will be Dr. Lee's responsibility, he will utilize information obtained from a number of individuals within the Central Valley Regional Water Quality Control Board (Drs. Chris Foe and Val Connor), members of the UCD Aquatic Toxicology Laboratory staff (L. Deanovic), and Scott Ogle of Pacific Eco-Risk, Martinez, California, as well as Dr. Jeff Miller of AQUA Science, Davis, California, private laboratories who have been involved in these issues for a number of years. Dr. Miller has recently developed a new TIE procedure that is particularly useful for identifying unknown toxicity in the presence of diazinon and chlorpyrifos.

Since the full US EPA Phase III TIE procedure can cost in the order of $10,000, and several full Phase III TIEs may be needed to identify the constituents primarily responsible for aquatic life toxicity in San Diego Creek waters as they enter Upper Newport Bay, it could occur that there are insufficient funds to carry out the TIE investigations to completion. Consideration has already been given to working with the Santa Ana Regional Water Quality Control Board (Hope Smythe) in submitting a request for supplemental funding for TIE studies. The justification for such funding is that these studies are an integral, necessary part of this regional board's efforts to develop a TMDL for toxics in San Diego Creek and Upper Newport Bay.

It may not be possible to identify, through TIEs, the specific cause(s) of the majority of the components responsible for aquatic life toxicity in San Diego Creek water. If this situation should develop, then an alternative approach will be used, where through forensic studies, combined with TIEs, it may be possible to track to the origin, the source of the unknown toxic components. Once the source is known, then it will likely be possible, through examining the chemicals used at the source, to determine the constituents responsible for the unknown toxicity. It is likely that a combination of partial to full Phase III TIEs and forensic-TIE studies within the watershed will be

used to determine the causes of the unknown toxicity that have been identified in San Diego Creek waters in the fall of 1996 and 1997.

Water Quality Significance of *Ceriodaphnia* and Mysid Toxicity

The major emphasis of the Upper Newport Bay studies should be devoted to assessing the water quality significance of the San Diego Creek aquatic life toxicity on the beneficial uses of Upper Newport Bay. While in the past, and currently, toxic conditions such as those found in San Diego Creek would be considered sufficient to initiate regulatory activity if these conditions arose from a point-source discharger, such as a POTW, toxic conditions associated with stormwater runoff do not necessarily lead to regulatory action even if they represent a violation of a regional board's basin plan objectives. Further, the State Water Resources Control Board's fall 1996 proposed approach for implementing the California Toxics Rule, under "Chronic Toxicity Objective," states: "Surface Waters Outside of Any Allowed Mixing Zones shall Be Free from Lethal or Sublethal Toxicity at Levels Which Impair Designated Aquatic Life Beneficial Uses." It therefore becomes important to determine whether the toxicity of San Diego Creek waters as they enter Upper Newport Bay in each stormwater runoff event is of sufficient magnitude, areal extent and duration to be significantly adverse to the aquatic life-related beneficial uses of the Bay.

The assessment of organophosphate pesticide toxicity in causing adverse impacts on small and larval forms of aquatic life is not easily accomplished. Because of the high variability and the variety of factors that influence the numbers, types and characteristics of desirable forms of aquatic organisms within the Bay, it will not be possible to examine the aquatic life organism assemblages in the Bay to determine if the toxic pulses of stormwater are significantly adverse to the desirable forms of aquatic life within the Bay. Instead, it will be necessary to develop an approach which can be used by regulatory agencies and the Upper Newport Bay water quality stakeholders to determine when the magnitude, areal extent, duration, and types of organisms impacted is sufficient to warrant regulatory action to control the urban and/or agricultural use of pesticides beyond the current control program.

The initial phase of the work devoted to assessing the water quality significance/use impairment of Upper Newport Bay waters do to organophosphate pesticide caused toxicity should focus on reviewing the information available on the mixing of San Diego Creek waters with Upper Newport Bay waters during and following a stormwater runoff event. This mixing will determine the rate of dilution of the Creek waters with the Bay waters. Under most conditions, it is expected that San Diego Creek waters will float as a lens on top of the more saline Bay waters. It is understood that essentially all aquatic life brought into the Bay via San Diego Creek waters will be killed due to the salinity of the Bay waters. The issue then becomes one of mixing of the Creek waters with Bay waters, where the toxicity could impact marine organisms that are present in the salt water/fresh water lens (area of mixing) that develops with each stormwater runoff event. The characteristics of this lens will be dependent on tide stage, magnitude, duration and other characteristics of the Creek discharges to the Bay, as well as mixing and transport processes that occur within the Bay. An RBF staff member, D. Neiter, has the responsibility of compiling all

available information on salinity profiles within Upper Newport Bay as a function of stormwater runoff event and tide stage. The overall objective of this effort is to try to develop general descriptions of mixing profiles, both vertical and longitudinal, that would describe how a chemical constituent, present in this freshwater input to the Bay, would be diluted by marine waters within the Bay.

From the studies completed thus far, it is known that marine organisms, such as mysids, are at least as sensitive, and possibly more sensitive, to some organophosphate pesticide toxicity than *Ceriodaphnia*. It is possible that San Diego Creek waters could be diluted by 20-fold or so with marine waters and still be toxic to some marine organisms. There could, therefore, be a substantial body of water within the Bay associated with some stormwater runoff events that could be toxic to marine organisms. It will be important to determine whether such conditions prevail for a sufficient period of time and to sufficient areal extent to adversely impact key sensitive organisms for the Upper Newport Bay aquatic ecosystem/beneficial uses.

If insufficient information is available to generally characterize the mixing of San Diego Creek waters during stormwater runoff events with Upper Newport Bay waters, then it will likely be necessary to do some sampling of Upper Newport Bay waters to develop the information base needed to predict expected mixing of San Diego Creek stormwater runoff waters with Bay waters within the Bay.

It is anticipated that once it is possible to predict how a conservative (non-reactive) chemical present in San Diego Creek waters would mix with Upper Newport Bay waters, then specific sampling would be conducted within the Bay during a stormwater runoff event to determine whether the predicted dilution of toxicity and toxic components matches what is found within the Bay.

The issues being faced with respect to assessing the water quality significance of organophosphate pesticide toxicity in San Diego Creek and Upper Newport Bay are not peculiar to this system. Exactly the same kinds of issues will need to be addressed throughout the state, and for that matter, the country, associated with urban stormwater runoff organophosphate pesticide toxicity. During the past year, Dr. Lee has been devoting time to the issue of determining what represents excessive *Ceriodaphnia* and mysid toxicity in Upper Newport Bay and San Diego Creek as it may impact the beneficial uses of a waterbody. He has introduced this topic into the Sacramento River watershed studies, the CALFED Sacramento River/San Joaquin River Delta studies and the Urban Pesticide Committee review of pesticide toxicity issues.

It is Dr. Lee's intent to organize an expert panel that would work toward developing guidance on how regulatory agencies and a group of stakeholders concerned about appropriately regulating aquatic life toxicity due to organophosphate pesticides, and for that matter, other constituents, in urban stormwater runoff, could determine when the toxicity is of sufficient magnitude to key ecosystem organisms, extent and duration to justify significantly curtailing the use of pesticides in urban areas because of their adverse impacts on the beneficial uses of the receiving waters for stormwater runoff from these areas.

One of the issues that will need to be addressed is the amount of effort that should be devoted to determining the potential water quality and aquatic ecosystem significance of *Ceriodaphnia* toxicity that has been found in San Diego Creek waters to San Diego Creek aquatic life. Planktonic organisms in San Diego Creek, such as *Ceriodaphnia*-like organisms, may not receive a sufficient exposure/duration to toxic conditions to be adverse to them during a stormwater runoff event. Further, these organisms will all be killed when they get into Upper Newport Bay, due to the salinity of the Bay. While San Diego Creek is a freshwater system, it receives sufficient high TDS groundwater input to be toxic to *Ceriodaphnia* during base flow conditions. Since the toxic pulses of stormwater in San Diego Creek are apparently not adverse to fish, it is appropriate to question how much effort should be directed toward protecting San Diego Creek planktonic organisms from organophosphate pesticide toxicity. This is an issue that should be discussed at the January 6 meeting of the TAC.

Bioaccumulation of Hazardous Chemicals

One of the components of both the Evaluation Monitoring Demonstration project that is of importance with respect to toxic chemicals in San Diego Creek and Upper Newport Bay is the accumulation of hazardous chemicals in edible aquatic life tissue that cause the aquatic organisms to be unsafe for use as human food. This same situation may exist with respect to adversely impacting higher trophic level organisms such as fish-eating birds that use fish and other aquatic life as food. At this time, there are regulatory guidelines available for a number of chemicals that tend to accumulate within fish tissue to potentially hazardous levels for the use of the organisms as human food. There is limited information, however, on excessive bioaccumulation as it may impact higher trophic level aquatic life.

As part of the Phase I Evaluation Monitoring review of past studies on Upper Newport Bay water quality, Dr. Lee reviewed the State Water Resources Control Board's Toxic Substances Monitoring Program (TSM) data for fish and shellfish tissue residues from San Diego Creek and Upper Newport Bay. This data showed that edible aquatic organisms within these areas have been found to contain excessive concentrations of several chlorinated hydrocarbon pesticides, PCBs and mercury. During the summer of 1997, in cooperation with the Santa Ana Regional Water Quality Control Board (Hope Smythe), the State Water Resources Control Board TSM program sampled San Diego Creek and Upper Newport Bay fish and shellfish. This data is scheduled to be available for review in the spring of 1998. This data will be examined to determine the current situation on excessive bioaccumulation of hazardous chemicals in San Diego Creek and Upper Newport Bay aquatic life.

Also, consideration will be given to any major gaps in information that may exist in adequately defining whether current aquatic life within San Diego Creek and Upper Newport Bay contains excessive concentrations of hazardous chemicals. Of particular concern is the situation where the State WRCB TSM program does not necessarily use sufficient sensitivity in their analytical procedures to measure the concentrations of potentially hazardous chemicals at

sufficiently low levels to determine whether hazardous chemicals exist at concentrations that the US EPA Region 9 has proposed as guideline values for the San Francisco Bay region.

Also of concern is that there is no data on the dioxin content of San Diego Creek and Upper Newport Bay fish and shellfish. Since dioxins are being found ubiquitously throughout the environment, including within aquatic life tissue, at potentially hazardous levels, it will be important to have some San Diego Creek and Upper Newport Bay fish and shellfish analyzed for dioxins. Specific recommendations are expected to be made this spring on what additional sampling needs to be done to determine the full magnitude of the excessive bioaccumulation problem that exists in San Diego Creek and Upper Newport Bay fish and shellfish.

An issue that will need to considered with respect to evaluating excessive bioaccumulation of hazardous chemicals in San Diego Creek fish, is whether excessive bioaccumulation in these fish represents a threat to human health. Basically, are the fishery's resources of San Diego Creek used by anyone as food? If so, then the excessive bioaccumulation of hazardous chemicals within the fish that are used as food is an important issue that needs to be addressed. While these resources are used by higher trophic level aquatic life as food, except for PCBs, there are no reliable guidelines available on what constitutes excessive concentrations of hazardous chemicals in aquatic life tissue, as they may impact higher trophic level organisms. The TAC needs to discuss how it wishes to proceed with respect to managing bioaccumulation in San Diego Creek fish.

Additional Information

Additional information on the Phase I studies is available in the Phase I report. Questions about this report, as well as the initial Phase II results reported herein should be directed to Dr. Lee.